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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,770	03/22/2004	Michael Durr	282743US8X	1234

22850 7590 10/27/2009

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EXAMINER
TAI, XIUYU

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
10/27/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/805,770	DURR ET AL.	
	Examiner	Art Unit	
	Xiuyu Tai	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4,6-13,15-18 and 20-35* is/are pending in the application.

4a) Of the above claim(s) *25-34* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4,6-13,15-18,20-24 and 35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/11/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Due to applicant's amendments, rejections to claims 12-14 under of the second paragraph of 35 U.S.C. 112 are withdrawn.

2. Applicant's arguments with respect to claim1, 2, 4, 6-13, 15-18, 20-24 have been considered but are moot in view of the new ground(s) of rejection necessitated by applicant's amendments.

Claim Rejections - 35 USC § 112

3. Claims 4, 8, and 9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claims 4, 8, and 9 recites the limitation "said at least two layers" in line 2. There is insufficient antecedent basis for this limitation in the claim. The amended claim1 does not call for "at least two layers". Therefore, appropriate correction/clarification is required. For the purpose of examination, "the at least two layers" is interpreted as " the first and the second layer".

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1, 2, 7-13, 20, 21, 24, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chone (EP 1271580, cited in IDS) in evidence of Usami (*Theoretical study of application of multiple scattering of light to a dye-sensitized nanocrystalline photoelectrochemical cell*, cited in IDS).

9. Regarding claim 1, Chone is directed to a porous film of a solar cell (Figure 1, paragraph [0031]). The 2- layer TiO2 film 23 has a front face (i.e. close to the anode) and a back face (i.e. close to the cathode, [0031], Example 1 and 2). The 2-layer film includes a first layer and a second layer (paragraph [0031]). Both layers include small

particles ranging between 10-30 nm (i.e. a first kind of particles having one size) and big particles of 100-200 nm (i.e. a second kind of particles having larger size, paragraph [0026]).

Although the teaching of Chone may include tow kinds of particles in the first layer, it has been hold that omission of an element and its function is obvious if the function is not desired (see MPEP 2144). Chone also indicates that small particles assure sufficient surface area for the dye absorption while the big particles in the second layer increase the light scattering effect (paragraph [0024]). The first layer of Chone is deposited on the anode electrode (Figure 1, paragraph [0031]) and the light scattering effect may not be desired at the cell surface of Chone. Therefore, it would be obvious for one having ordinary skill in the art to eliminate big particles from the first layer in order for dye to absorb more light from small semiconductor particles.

Chone further teaches that the light scattering effect increases as particle diameter increases (paragraph [0024] and [0034]). As is evident by the teaching of Usami, particles size with the range of 15-30 nm are too small to utilize the scattering effect (page 107 of Usami). Therefore, the 2-layer of TiO2 film has a gradient of light scattering strength extending from the front face to the back face, with the light scattering strength increasing toward the back face because the first layer contains only small particles while the second layer has small and big particles.

10. Regarding claim 2, as is evident by the teaching of Usami, particles size with the range of 15-30 nm are too small to utilize the scattering effect (page 107 of Usami). Therefore, the cell surface of the modified teaching of Chone is inherent to have zero

light scattering strength because the first layer contains small particle ranged from 10-30 nm.

11. Regarding claim 7, Chone teaches the particles being semi-conducting particles (TiO_2) (abstract).

12. Regarding claim 8, the limitation of the at least two layers being applied subsequently is considered to be a product by process limitation. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (*In re Thorpe* and MPEP § 2113). Further, Chone teaches the two layers being applied subsequently (paragraph [0031]).

13. Regarding claim 9, the limitations of the instant claim are considered to be product by process limitations. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (*In re Thorpe* and MPEP § 2113). Further, Chone teaches a doctor blading method (paragraph [0040]).

14. Regarding claim 10, Applicant is directed above for a full discussion of Chone as directed to claim 1. Chone teaches the first kind of particles having an average diameter in the range of 10-30 nm (paragraph [0026)]. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (*In re Wertheim* and MPEP § 2144.05).

15. Regarding claim 11, Chone teaches the second kind of particles having an average diameter in the range of 100-200nm (paragraph [0026]). In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists (*In re Wertheim* and MPEP § 2144.05).

16. Regarding claims 12 and 13, Chone teaches that the proportion of the small particles and the big particles are such that they allow improving the photon conversion efficiency while keeping the dye absorption (paragraph [0037]). Therefore, one having ordinary skill in the art would have realized to optimize the volume ratio in order to achieve better performance of the solar cell. Chone teaches the ratio being a weight ratio (paragraphs [0026]-[0030]). Moreover, the instant specification does not provide criticality for these parameters.

17. Regarding claims 20-21, Chone teaches an electronic device (solar cell) comprising a porous film according to claim 1 (title, abstract, Figure 1).

18. Regarding claim 24, Chone teaches the solar cell further comprising an electrolyte (Figure 1(30)).

19. Regarding claim 35, Chone does not specifically disclose the filing having continuous scattering gradient, but Chone teaches that the scattering effect increases

with particles size (paragraph [0024]) and varying particle size and amount of particle in the film result in improving conversion efficiency by improving light scattering effect (paragraph [0027]). Therefore, one having ordinary skill in the art would have realized to change the scattering strength continuously along the film by varying particle size and amount present in the film in order to improve conversion efficiency.

20. Claims 4, 6, 15-18, and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chone (EP 1271580, cited in IDS) as applied to claim 1 above, and further in view of Usami (*Theoretical study of application of multiple scattering of light to a dye-sensitized nanocrystalline photoelectrochemical cell*, cited in IDS).

21. Regarding claim 4, the modified teaching of Chone has a first layer having small particles and a second layer having similar particle and big particles.

Chone is silent as to the porous film having three layers. However, Usami teaches a layered film structure having small particle film and large particle film at the bottom (Figure 4) in order to increase the overall photoactive region (page 108). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the device of Chone to have multiple (3) layers as taught by Usami (Figure 4) to increase the overall photoactive region.

22. Regarding claim 6, Chone is silent as to the particles having a shape selected from the group consisting of rods, tubes, cylinders, cubes, parallelipeds, spheres, ball and ellipsoids. But, Chone does disclose the size of the particles in terms of diameter (paragraph [0026]). However, it is known in the porous film for solar cell art to utilize ball shape TiO_2 particles in a porous device, as taught by Usami (pp 106, 1st column, 1st

paragraph and Figure 4) as such a shape is well known in the art and easy to manufacture. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize ball shaped metal oxide particles as taught by Usami in the device taught by Chone as such a shape is well known in the art and easy to manufacture.

23. Regarding claim 15, Chone teaches a porous film (2-layer structure) with a first kind of particles of one average diameter and a second kind of particle with a larger average diameter (paragraph [0026]). Usami teaches a layer having only a first kind of particle (smaller particle) (see Figure 4) to ensure proper dye absorption in a solar device. Further, Usami teaches the use of multiple layers of metal oxide particles in such a porous device (Figure 4) to increase the overall photoactive region. It would have been obvious to one of ordinary skill at the time of the invention to include a layer of only one kind of particle in a plurality of layers as taught by Usami in the device taught by Chone to ensure proper dye absorption and minimize light scattering at the top of the device as well as increasing the overall photoactive region.

Further, Chone teaches the average diameter of the second kind of particle being in a range of 100-200nm (paragraphs {0024]-[0026]) and teaches the second layer having a porosity between 55% and 65% to improve the light scattering effect (paragraph [0031]). Chone/Usami is silent as to either (i) the average diameter of the second kind of particles being the same in each layer and the amount of the second kind of particles present in the layers varies from layer to layer or (ii) the amount of the

second kind of particles present in the layers being the same in each layer and the average diameter of the second kind of particle varying from layer to layer.

However, it is taught in Chone that both the diameter of the particle as well as the density of the layer (i.e the porosity) are varied to achieve a desired light scattering effect.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention through matters of routine experimentation to optimize the changes in diameter of the second kind of particle and/or the porosity of the layer as taught by Chone. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (*In re Aller* and MPEP § 2144.05).

24. Regarding claim 16, Chone/ Usami is silent as to the amount of the second kind of particles present in each layer varying from layer to layer, increases from layer to layer, and where the average diameter of the second kind of particles present in each layer varying from layer to layer, increases from layer to layer.

However, it is known in the art that increasing the diameter and/or number of particles improves the photon conversion efficiency of the cell by improving the light scattering effect (Chone, paragraph [0027] and [0031]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to increase the diameter and/or number of particles from layer to layer to further increase the light scattering effect thereby improving the photon conversion efficiency of the cell, as taught by Chone.

25. Regarding claims 17-18, Chone/ Usami teaches the one layer having only a first kind of particles being closer to the front face (i.e. adjacent to the front face) of the porous film than to the back face (Usami, Figure 4).

26. Regarding claims 22-23, Chone is silent as to the solar cell further comprising a reflective back electrode and a light confinement layer.

However, it is known in the solar cell art to include a reflective back electrode and a light confinement layer in a solar cell to ensure effective solar energy absorption in the device, as taught by Usami (pp 108, 2nd column, 2nd paragraph).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to include a reflective back electrode and a light confinement layer in the device of Chone to ensure effective solar cell energy absorption in the cell, as taught by Usami.

Conclusion

27. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Xiuyu Tai whose telephone number is 571-270-1855. The examiner can normally be reached on Monday - Friday, 7:30 AM - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Michener can be reached on 571-272-1424. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/X. T./
Examiner, Art Unit 1795
/Jennifer K. Michener/

Supervisory Patent Examiner, Art Unit 1795